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National Animal Health Monitoring System

United States
Department of
Agriculture

Animal and
Plant Health
Inspection
Service

**Veterinary
Services**

MICHIGAN REPORT

NAHMS

Summary of Round 1
July 1986 through June 1987

National Animal Health Monitoring System

Acknowledgment

The Michigan Report - Round 1 has been prepared from data collected and analyzed under the direction of the Division of Epidemiology, Michigan State University College of Veterinary Medicine, coordinated by Dr. J.B. Kaneene and Dr. H.S. Hurd. The University worked in cooperation with the U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Veterinary Services (VS), and the Michigan Department of Agriculture.

We are grateful to the producers who diligently kept records of their operations, the Veterinary Medical Officers (VMOs) who collected the data, the practitioners who provided information regarding diagnosis and drug charges, and personnel of the Division of Epidemiology at Michigan State University for managing and processing the data. All participants are to be commended for their efforts. The names of those who coordinated and participated in the collection and processing of the data are listed below. Producers' names are withheld because of the confidentiality granted to them.

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Michigan Veterinary Medical Association

957430

Michigan Report

Contents

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Introduction

NAHMS, the National Animal Health Monitoring System, is a cooperative State-Federal-industry effort to provide statistically sound estimates of the incidence and prevalence of animal health events and their associated costs.

The program converts raw on-farm data into orderly and meaningful information by using epidemiological methods to collect, analyze, and report the results. With appropriate sampling procedures and statistical research analyses, the NAHMS information provides a basis for measuring and documenting data at the State and National level.

A random selection of producers in Michigan will ensure that the animal health events recorded reflect events statewide. Information from other participating States will eventually be included in the data base to reflect regional and National animal health trends.

Objectives

The State of Michigan agreed to pilot a system of collecting and analyzing information related to animal health. The objectives of the first round of the program were to:

- *Collect statistically valid data about animal health and production events in dairy cattle.*
- *Produce statistically valid estimates of the incidence, prevalence, and costs of dairy cattle health and production-related events in the State of Michigan.*

Background

Michigan initiated Round 1 in July 1986 and completed data collection in June 1987. The NAHMS concept involved obtaining a standard core of data from each participating producer through on-farm interviews. These data provided a broad picture of animal health and production events and their associated costs in the State.

Dairy farming is the most economically important livestock industry in Michigan. Based on the economic significance of dairy cattle and the limited resources available for data collection, the decision was made to monitor only dairy operations during Round 1.

Role of Participants

State, Federal, and university VMOs asked the producers to keep a daily log of all dairy health and production-related events. NAHMS defines a health event as any illness or condition that affects the overall health of the animal. Measures used for the prevention and treatment of disease and estimated costs associated with each health event were also recorded. Veterinary practitioners working with the participating herds provided information and cost data regarding diagnosis, vaccines, and drugs used.

The VMOs visited the producers monthly for 12 months to collect the data. A NAHMS Coordinating Committee worked with State and Federal VMOs, personnel at Michigan State University, and producers throughout the round to coordinate the collection, analysis, and reporting of dairy health events and costs.

Selection of Producers

Data and maps from the National Agricultural Statistics Service and Michigan Crop Reporting Service were used to select a sample of dairy herds. Counties, areas within counties, and the number of herds in each herd size

Selection of Producers (continued)

category were determined. A total of 6,012 dairy herds were identified as a result of this procedure. Using these data, the State was stratified into six geographical districts and the following four strata according to the number of adult cows in the herd: 10-49, 50-99, 100-199, and 200+ cows.

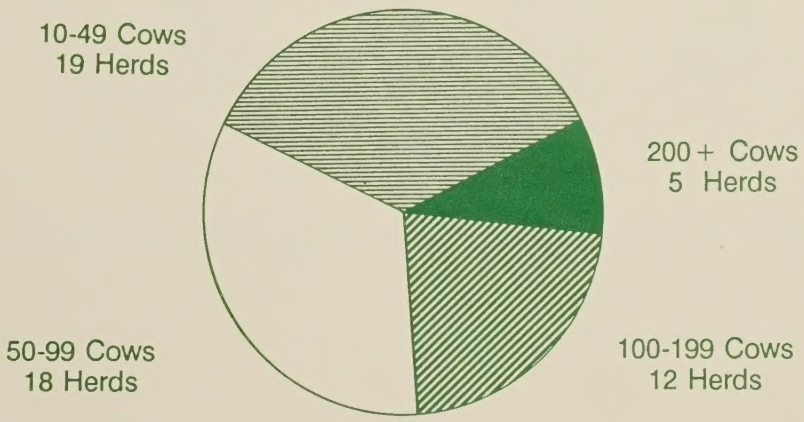
VMOs confirmed the location of herds in specified areas with the help of milk inspectors and dairy extension specialists. Information on the number of available herds in each size category was given to the NAHMS Coordinator. Using a simple random procedure, the Coordinator selected eligible producers within each stratum. Of the 60 dairy herds projected to be included in the sample, 58 initially agreed to participate.

Dairy Operations Monitored

Data on health events and associated costs were collected from July 1986 through June 1987 from 54 of the 58 Michigan dairy herds that agreed to participate. Four producers were excluded because of incomplete data.

Figure 1 shows that herds having 200 or more cows represented the smallest proportion of herds monitored. This corresponds to the proportion of that herd size category in the State.

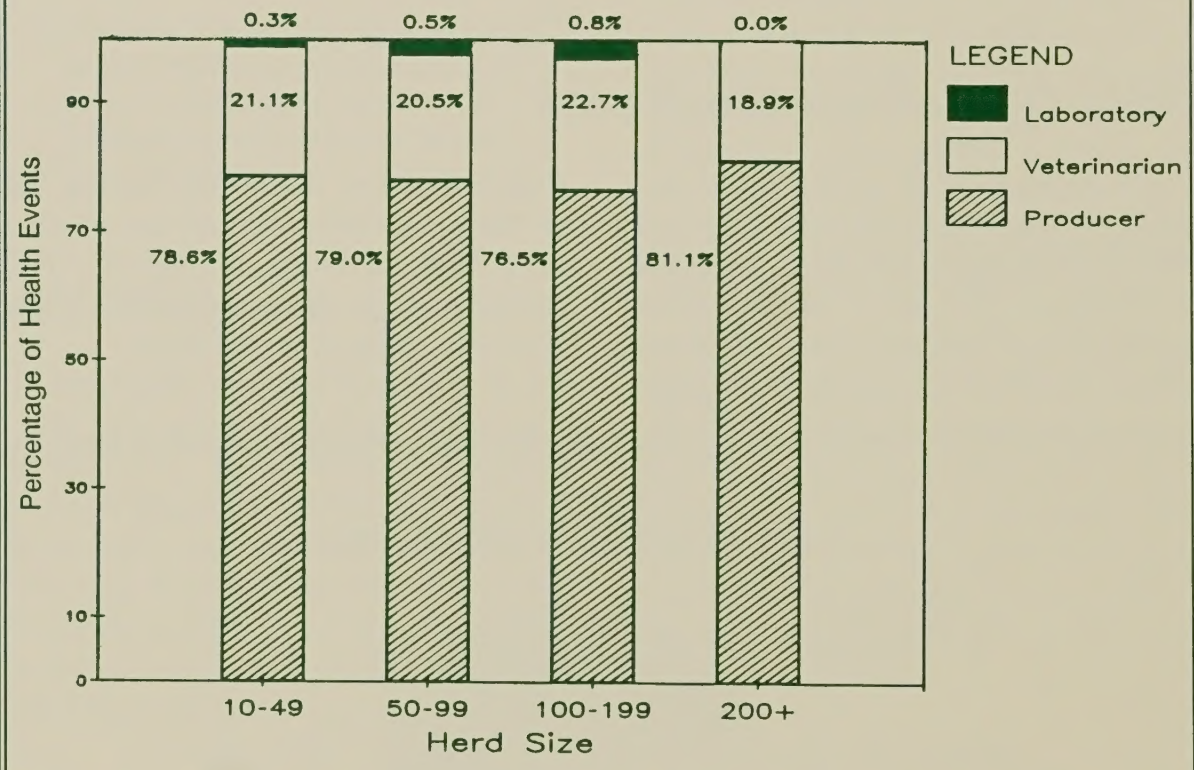
Figure 1
Dairy Operations Monitored



Health Events Reported

As shown in Figure 2, producers identified most of the health events within each herd size category. None of the health events reported in herds having 200 or more cows were diagnosed by a laboratory.

Figure 2
Identification of Health Events



Dairy Cows

Table 1 shows that clinical mastitis was the most commonly reported disease, but metritis was a close second. Repeat/problem breeder syndrome ranked a distant third in frequency.

Table 1
Ten Most Frequently Reported Health Events in Cows

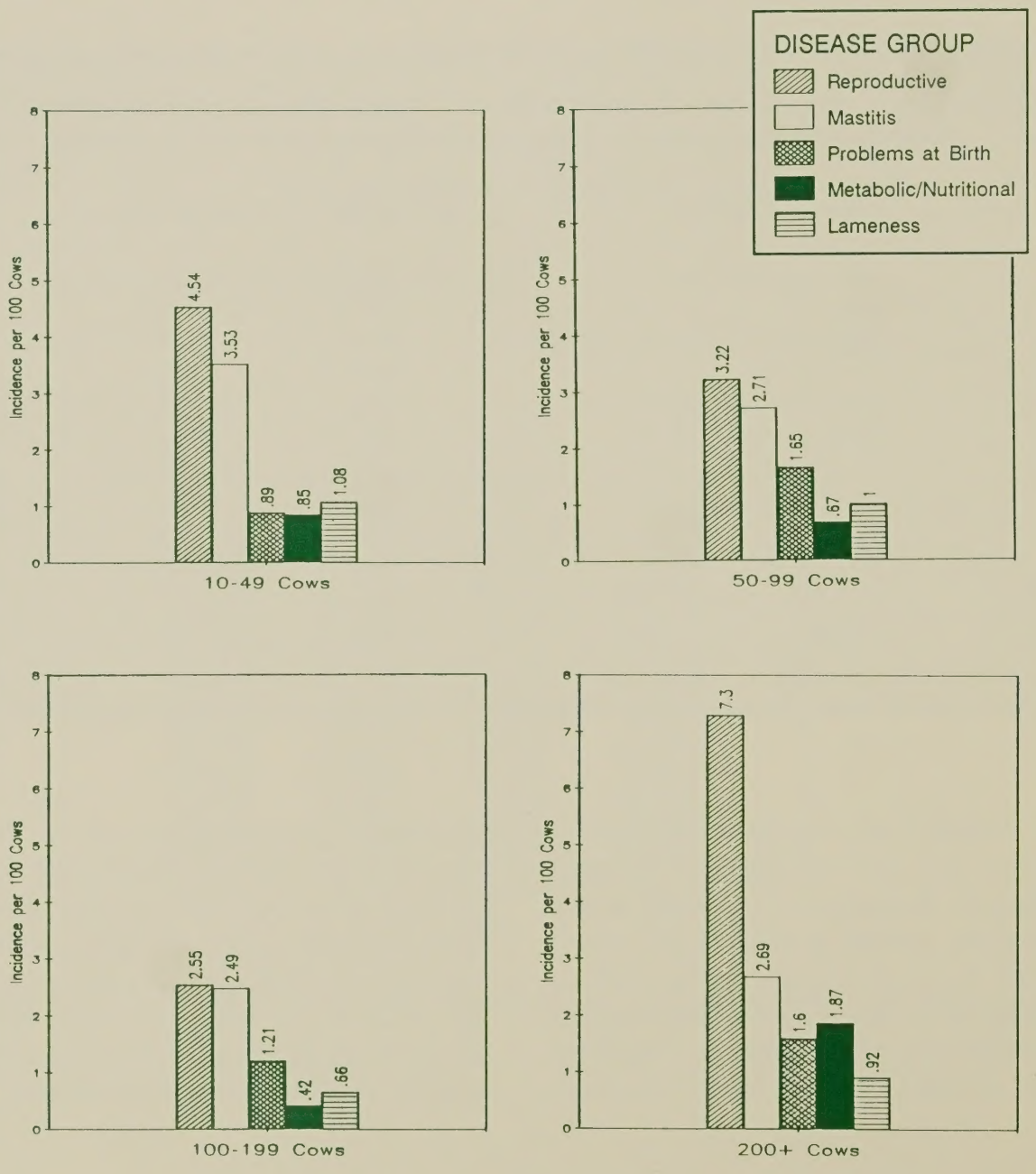
Health Event	# Cases	Percentage
Clinical Mastitis	1,296	30.2%
Metritis	1,140	26.6%
Repeat/Problem Breeder	410	9.6%
Lameness	262	6.1%
Retained Placenta	254	5.9%
Milk Fever	234	5.5%
Dystocia	217	5.1%
Cystic Ovary	169	3.9%
Ketosis	156	3.6%
Anestrus	152	3.5%
Total	**4,290**	

NAHMS uses incidence rates to express the risk of disease in food animals. In each of the 54 dairy herds, monthly incidence rates were calculated for each disease by age (cows, young stock, and calves). The number of new cases of a disease in a herd (in one month) divided by the average population of animals at risk in the herd (for one month) determined the monthly incidence rate for the herd. Herd monthly incidence rates, which were assumed to equal the one-month risk adjusted for herd size, were then averaged for the year to determine an average monthly risk for each disease.

Dairy Cows (continued)

Figure 3

Average Monthly Disease Risks in Cows by Herd Size

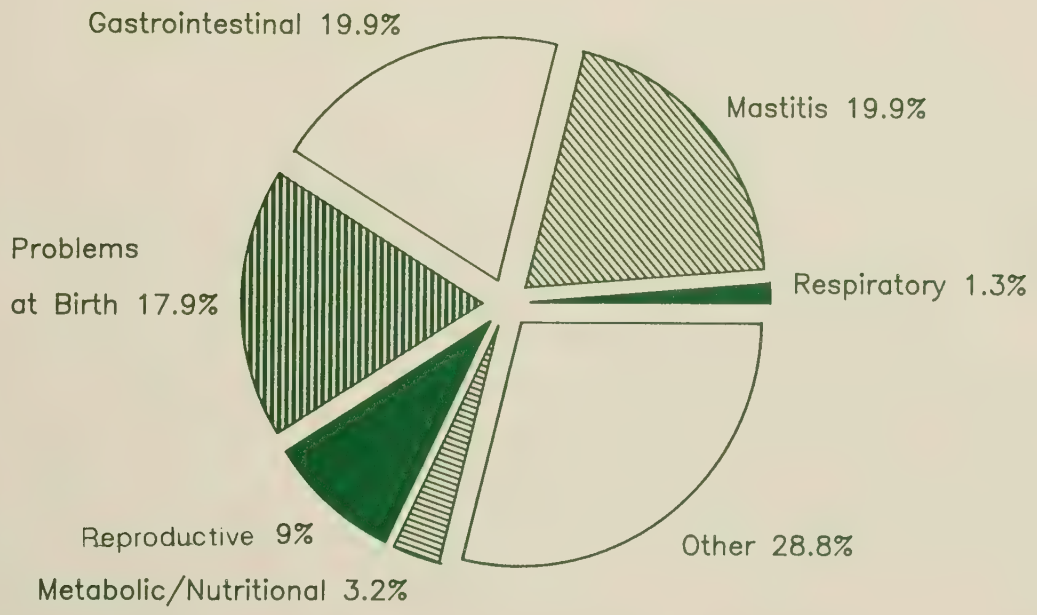


Dairy Cows (continued)

Figure 3 shows average monthly risks by herd size of five disease groups in adult cows, both milking and dry. Cows in the largest herd size category were at the highest risk for breeding problems. A producer having 200 or more cows could expect, on the average, 7.3 cases of breeding problems per 100 cows per month. In general, herds containing 100 to 199 cows experienced the least disease.

Proportionate mortality ratios (PMRs), by disease group and age, were used to represent the percentage of deaths due to a specific cause. The number of deaths due to a given disease divided by the total number of deaths defines the PMR. Figure 4 shows that mastitis and gastrointestinal problems in cows had an equal PMR of 19.9%. This means that for every 100 cow deaths, 19.9 were due to mastitis and 19.9 were caused by a gastrointestinal condition.

Figure 4
Proportionate Mortality Ratios for Cows



Dairy Cows (continued)

Table 2
Total Costs of Health Events in Cows

Disease Group	Herd Size (# Cows) 10-49	50-99	100-199	200 +	Total
Reproductive	$12,110	$ 52,344	$26,121	$ 35,255	$125,830
Mastitis	14,518	35,454	34,932	31,246	116,150
Problems at Birth	7,872	19,638	10,300	14,229	52,039
Gastrointestinal	9,272	12,283	7,463	13,153	42,171
Lameness	3,281	8,868	6,489	2,913	21,551
Metabolic/Nutritional	4,206	9,236	1,949	6,043	21,434
Respiratory	738	1,132	1,311	631	3,812
Total	**$51,997**	**$138,955**	**$88,565**	**$103,470**	**$382,987**

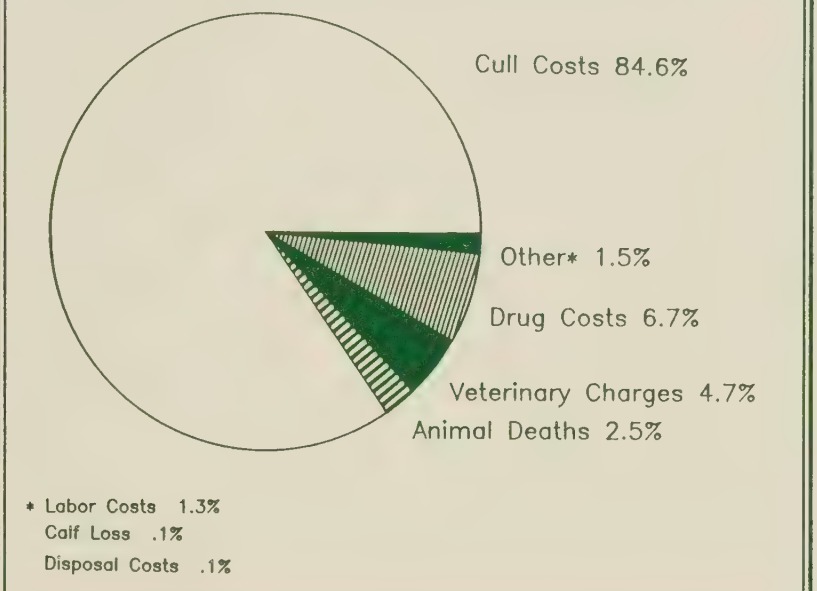
Total costs of an animal health event included the costs of drugs, veterinary charges, labor, culls, animal loss, dead calves, milk loss, and preventive measures collected over the 12-month study period. (See the Glossary on page 19 for definitions of the cost categories.)

The total costs of health events in the dairy cows monitored equaled $382,987. Table 2 shows that breeding problems and mastitis were the most expensive disease groups as a whole and within each herd size stratum. Respiratory diseases accounted for only 1% of the total disease costs in cows.

Dairy Cows (continued)

Figure 5 shows that costs of culling were the most significant cost category for reproductive problems in the cows monitored. Culling costs for other diseases, such as mastitis, were lower.

Figure 5
Costs of Reproductive Problems in Cows



Estimated total costs of health events per cow at risk per year by herd size are given in Table 3. Costs of mastitis were the highest, ranging from $36.32 to $54.46 per cow. Reproductive problems were the next most expensive disease group on a per head basis, followed by problems at birth. The table indicates, for example, that a producer with 200 or more cows can expect to lose at least $7.72 per cow in the next year due to lameness.

Table 3
Total Costs of Health Events Per Cow Per Year

Disease Group	Herd Size (# Cows) 10-49	50-99	100-199	200+
Mastitis	$36.32	$42.71	$54.46	$51.05
Reproductive	27.35	34.49	33.98	40.81
Problems at Birth	13.69	18.62	12.82	16.63
Gastrointestinal	11.59	8.88	9.09	10.54
Lameness	7.82	9.47	10.67	7.72
Metabolic/Nutritional	8.23	8.16	3.91	7.01
Respiratory	1.92	1.42	2.02	1.48

Dairy Young Stock

Table 4
Ten Most Frequently Reported Health Events in Young Stock

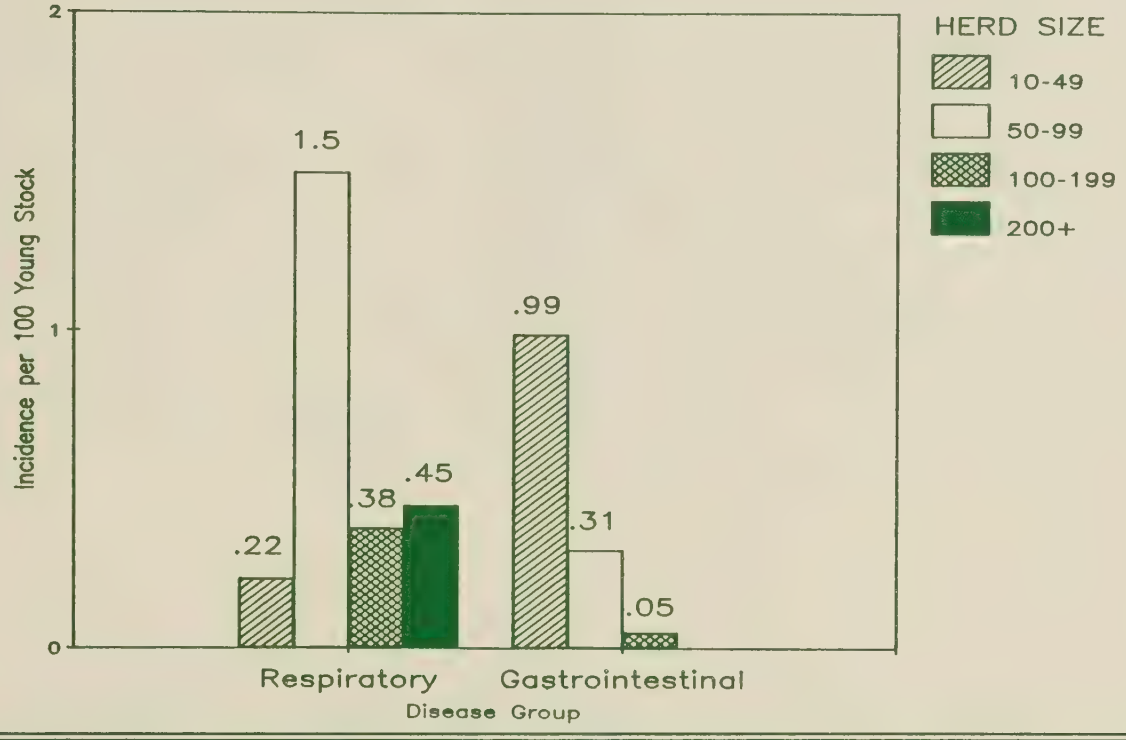
Health Event	# Cases	Percentage
External Parasites	198	36.1%
Respiratory	164	29.9%
Mycotic Dermatitis	100	18.2%
Repeat/Problem Breeder	27	4.9%
Coccidiosis	13	2.4%
Injury, Nonspecific	12	2.2%
Disease, Unspecified	10	1.8%
Lameness	9	1.6%
Accident	8	1.5%
Infection, Nonspecific	7	1.3%
Total	**548**	

Dairy animals from weaning age until first calving (females) or first breeding (males) were classified as young stock. The ten most frequently reported diseases and conditions in young stock are listed in Table 4. External parasites was the most commonly reported problem, representing 36.1% of all cases. The most common parasite was lice. The number of repeat/problem breeders may be underreported since most of the cases were recorded when the animal was culled as a result of the problem.

The remaining tables and figures summarizing the results for young stock pertain to the respiratory and gastrointestinal systems only, due to the small number of cases and associated costs reported for the other disease groups. (Refer to the list of Health Events by Disease Group on page 21 for specific conditions included in the respiratory and gastrointestinal body systems.)

Dairy Young Stock (continued)

Figure 6
Average Monthly Disease Risks in Young Stock



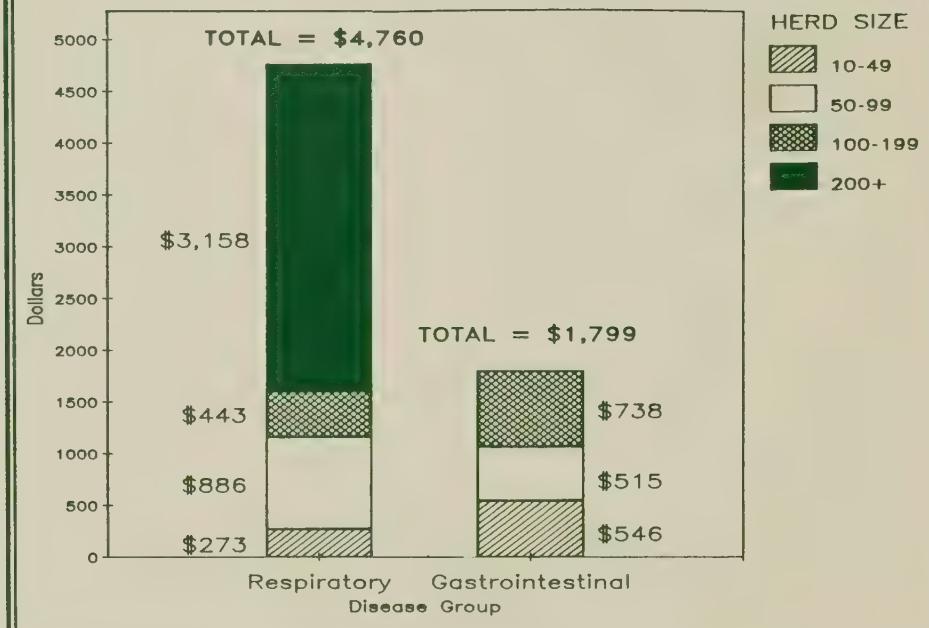
The average monthly risks in young stock for respiratory and gastrointestinal conditions by herd size are presented in Figure 6. The risk of respiratory disease in young stock was highest in herds having 50 to 99 cows. Based on the 18 herds in this stratum, 1.5 cases of respiratory disease could be expected per 100 young stock each month. Large herds had minimal risk for gastrointestinal disease. All risks are relatively low as compared with cows.

The proportionate mortality ratio (PMR) for gastrointestinal diseases in young stock was almost nine times higher than that for respiratory diseases. (PMR is discussed in detail on page 7.) The PMR for gastrointestinal diseases was 37.0% while the respiratory disease group showed a 4.3% PMR. A PMR of 58.7% was attributed to other disease groups. For every 100 deaths among young stock, 37 resulted from a gastrointestinal condition and 4.3 were attributed to a respiratory disease.

Dairy Young Stock (continued)

Total costs for gastrointestinal and respiratory diseases in young stock amounted to $6,559. Figure 7 shows that total respiratory disease costs ($4,760) were almost three times greater than total gastrointestinal disease costs ($1,799).

Figure 7
Total Costs of Health Events in Young Stock



The total costs of respiratory disease per head were highest in the largest herd size stratum (Table 5). Producers with 200 or more cows could expect to pay $3.94 in total respiratory disease costs per young stock per year. No costs were reported for gastrointestinal conditions in young stock among herds having 200 or more cows.

Table 5
Total Costs of Disease Groups per Young Stock per Year

Disease Group	Herd Size (# Cows) 10-49	50-99	100-199	200+
Gastrointestinal	$1.08	$0.82	$0.84	$ 0
Respiratory	$0.84	$0.96	$1.59	$3.94

Dairy Calves

Table 6
Health Events Reported in Dairy Calves

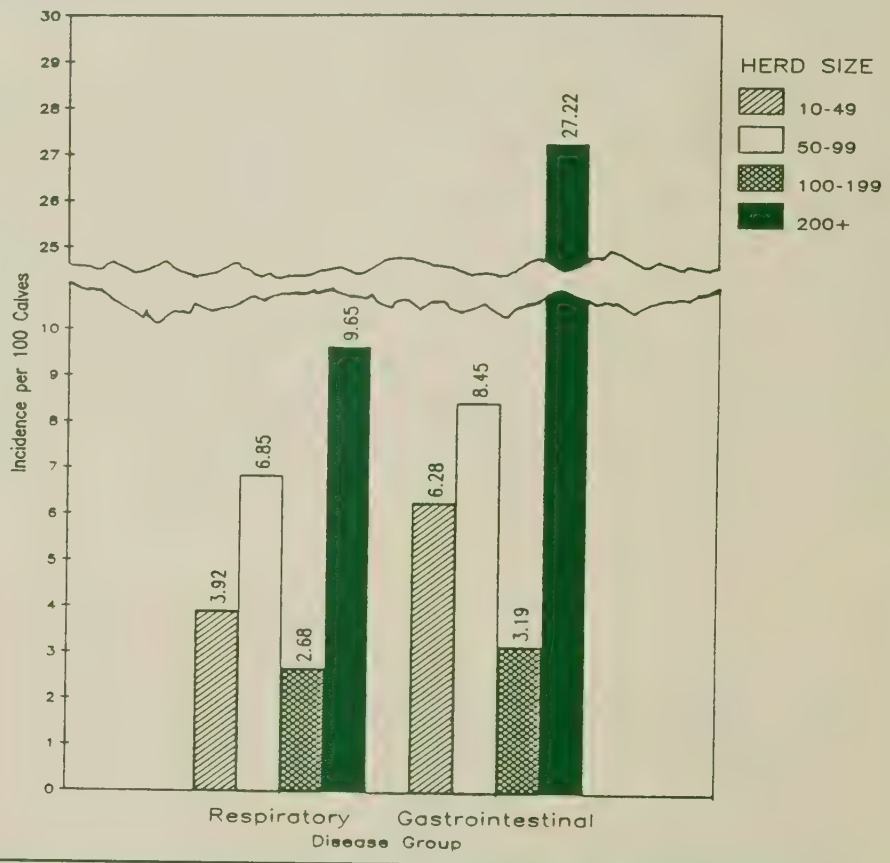
Health Event	# Cases	Percentage
Diarrhea	506	57.2%
Respiratory	243	27.5%
Pneumonia	57	6.4%
Disease, Unspecified	36	4.1%
Neonatal Death	15	1.7%
Coccidiosis	11	1.2%
Other	17	1.9%
Total	**885**	

Dairy calves included animals from birth until weaning off liquid rations. A total of 885 health events were identified in the calves monitored. Table 6 shows that diarrhea accounted for more than half of the reported cases, and respiratory conditions ranked second. Health events in the "Other" disease group included six cases each of bloat and weakness, and five cases of off feed.

Dairy Calves (continued)

As in young stock, the figures and tables that follow focus on the incidence and costs of gastrointestinal and respiratory events, due to the infrequent occurrence of cases among the remaining disease groups.

Figure 8
Average Monthly Disease Risks in Calves



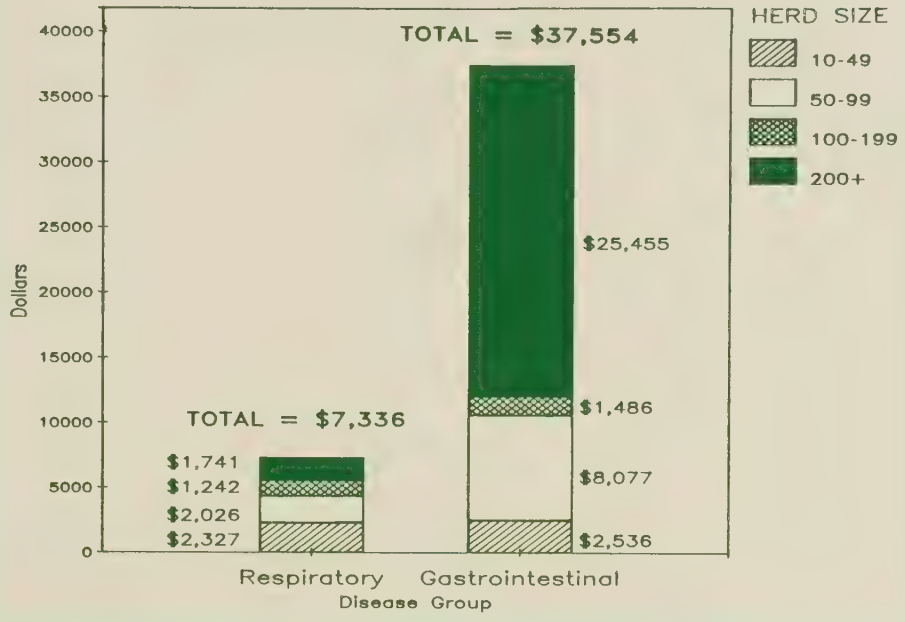
Calves in the largest herd size stratum experienced the greatest risk per month of gastrointestinal and respiratory disease as shown in Figure 8. On the average, in herds having 200 or more cows, 27.22 cases of gastrointestinal disease and 9.65 cases of respiratory disease would be expected per 100 calves each month.

Calves from dairy herds with 100 to 199 cows were at the lowest risk of contracting gastrointestinal and respiratory diseases. Gastrointestinal diseases were responsible for more deaths in calves than respiratory diseases, the reverse of what was reported in young stock. Sixty-two of every 100 calf deaths were attributed to gastrointestinal diseases and conditions, indicating a PMR of 62.0%. Diseases and conditions of the respiratory system accounted for 16.8 of every 100 calf deaths for a PMR of 16.8%. Other disease groups accounted for the remaining 21.2% PMR.

Dairy Calves (continued)

Total costs for gastrointestinal health events in calves ($37,554) were more than five times greater than respiratory disease costs ($7,336). This ranking contrasts with the total cost data for young stock given in Figure 7. In calves, gastrointestinal disease costs were larger than respiratory disease costs within each herd size stratum as shown in Figure 9.

Figure 9
Total Costs of Health Events in Calves



Total estimated costs per calf were higher for gastrointestinal diseases than for respiratory diseases, as shown in Table 7. The cost of $374.94 per calf for gastrointestinal diseases in herds having 200 or more cows was due to two consecutive months of calf scours on one operation during which the entire calf population died.

Table 7
Total Costs of Disease Groups per Calf per Year

Disease Group	Herd Size (# Cows) 10-49	50-99	100-199	200+
Gastrointestinal	$20.42	$63.26	$12.94	$374.94
Respiratory	$15.74	$11.85	$10.50	$ 23.50

Herd Management Practices

Producers from 49 of the 54 sampled dairy herds completed an initial herd survey at the beginning of the round and an extensive management survey at the end of the study period. The data was incomplete for the remaining five producers. Table 8 displays some of the results of these surveys. The total of the percentages for each management category may exceed 100 because a producer may employ more than one type of management practice in his herd.

Most calves were housed in a building separate from the one in which cows were housed. More than one quarter of the responding producers sampled used calf hutches.

Most of the producers used free stall housing and/or stanchions for their lactating cows. A variety of milking parlor types were reported.

Silage and hay were the most common feedstuffs employed. Almost one quarter of the producers responding to the surveys reported no routine analysis of major feedstuffs during the year. Of those doing feed analysis, 46.9% had their feeds analyzed one to three times per year.

Customized rations were fed to milking cows by 73.5% of the producers responding. Young stock were rarely given custom rations. A commercial feed representative commonly provided the producer with nutritional advice to formulate rations.

All 49 producers used a veterinarian at least once a year. Most (61.2%) employed veterinary services one to two times per month. Only 16.3% had veterinary visits fewer than once a month. Most visits were made to treat sick animals; 29 producers (59.2%) reported using a veterinarian for herd health.

A majority (64.6%) of the producers reported that they did not schedule time for heat detection. A bull was used by 14% of the producers not concerned with the detection of estrus. Tail paint and K-mar was used by 14.4% and 21% of the responding producers, respectively. Fifty-five percent of the producers utilizing artificial insemination performed the procedure themselves rather than hiring someone.

Table 8
Management Practices Reported

Management	# of Producers Reporting Use of the Practice	Percentage of Reporting Producers
Housing for Calves:		
Separate Calf Barn	26	53.1%
Calf Hutch	14	28.6%
In Cow Barn	17	34.7%
Housing for Lactating Cows:		
Free Stalls	27	55.1%
Stanchions	19	38.8%
Dry Lot	11	22.4%
Other	15	30.6%
Frequency of Major Feed Analysis:		
1-3 times per year	23	46.9%
4-5 times per year	12	24.5%
None	12	24.5%
Customized Rations for:		
Milking Cows	36	73.5%
Dry Cows	23	46.9%
Young Stock	13	26.5%
Nuitritional Consultation by:		
Commercial Feed Representative	23	46.9%
Feed Mill	17	34.7%
Veterinarian	10	20.4%
Extension Service	4	8.2%
Private Consultant	4	8.2%
Frequency of Veterinary Visits		
No visits per month	8	16.3%
1 - 2 times per month	30	61.2%
3 or more times per month	8	16.3%

Projected State Costs

Table 9
Estimated Expenses for Michigan Dairy Herds

Cost Category	Cost per Herd per Year*	Estimated Costs for All Michigan Dairy Herds
Veterinary Services	$620	$3.73 million
Drugs	553	3.33 million
Herd Health	251	1.51 million

*Costs based on 54 sampled NAHMS herds, adjusted for herd size.

Costs of veterinary services, drugs used for treatment, and herd health were estimated for all 6,012 dairy herds in Michigan using the cost data from the 54 sampled NAHMS herds. Herd health expenses include charges for routine reproductive examinations, nutritional consultation, and other non-disease-related charges by a veterinarian. Table 9 shows that veterinary service costs, when extrapolated to all dairy herds in the State, are the highest of the three cost categories at an estimated $3.73 million per year ($620 per herd per year multiplied by 6,012 herds).

Glossary

Abortion: The premature expulsion of the embryo or nonviable fetus. In NAHMS application, usually presumes a problem with the mother.

Animal health event: Any condition or disease that affects the overall health of an animal.

APHIS: Animal and Plant Health Inspection Service.

AVIC: Area Veterinarian in Charge.

Calf: In NAHMS dairy cattle, an animal from the time of birth until weaning off liquid ration.

Coccidiosis: A disease caused by infection with protozoa from the order Coccidia. The parasites usually attack the intestinal wall, resulting in gastrointestinal symptoms.

Costs (total): Direct expenditures in the production of meat and milk. Certain cost reductions due to disease are not included, such as reduction in feed costs from diseased animals off feed. Also, the long-term effects on cost structure are not addressed, such as reduction in reproductive efficiency.

Cost categories: The groups of expenses which contribute to the total costs of disease prevention and treatment.

Animal loss - The cost of animals which leave the herd, either as culls or as deaths. This figure includes the cost of a comparable replacement animal and costs associated with replacement, minus any salvage value from culled animals.

Drug costs - The cost of drugs used for the treatment of disease excluding those included in veterinary costs.

Labor - The cost of hired labor used for the prevention or treatment of disease. In Michigan NAHMS, the hours of labor reported were multiplied by the standard wage rate of $5.50.

Production loss - The cost of milk discarded during drug treatment, and any projected production loss due to disease.

Veterinary costs - Monies paid to a veterinarian for services and supplies for the treatment or prevention of disease.

Cow: An adult female of cattle that has calved.

Cull: To remove an animal because of a health event.

Cull cost: The replacement value of an animal minus the salvage value.

Dead calf costs: Costs of calves born dead due to a disease in the dam.

Disease groups: Similar disease conditions used in Michigan NAHMS grouped according to the body system affected.

Congenital defects - Abnormal conditions in calves at birth.

Gastrointestinal - Pertaining to the mouth, esophagus, stomach, intestines, and digestive processes in general.

Integumental - Pertaining to the skin and hooves.

Lameness - Events which make a cow lame.

Mastitis - Inflammation of the mammary gland, resulting in abnormal milk, diminished milk production, and possible other complications. Due to the importance of mastitis as a dairy cow problem, it is distinguished from the other urogenital problems.

Metabolic/Nutritional - Pertaining to disorders in which there is interference with the normal processing of substances by the body.

Multiple system - Problems which affect multiple body systems of the entire animal.

Musculoskeletal - Pertaining to the muscles, bones, joints, cartilages, and ligaments.

Organs of special sense - Pertaining to the organs of sense (smell, taste, vision, hearing, and equilibrium).

Problems at birth - Events occurring at or around the time of delivery.

Reproductive problems - Events which contribute to breeding failure.

Respiratory - Pertaining to the organs and structures involved in the act of breathing.

Urogenital - Pertaining to noninfectious disorders of the udder and diseases of the kidney, bladder, and reproductive tract.

Disposal cost: The fee to remove an animal from the herd, either alive or dead. This includes shipping costs and the cost of burial.

Feed analysis: The laboratory analysis of animal feeds for nutritional content.

Geographical district: A geographical division of the State, based on the size and location of dairy herds, for the purpose of selecting NAHMS herds.

Herd health: Routine veterinary services for a herd aimed at improving the overall health of the herd, excluding specific disease treatment. This also includes routine reproductive examination of cows.

Glossary (continued)

Incidence rate: A measure of the frequency with which new animal health events occur. The incidence rate is the total number of new occurrences of a disease divided by the total average exposed and susceptible population during a specified time period.

Milk loss: Pounds of milk reported lost multiplied by the herd's milk price for the month, adjusted for the percentage of discarded milk fed to calves.

NAHMS: National Animal Health Monitoring System.

Neonatal: Pertaining to the first four weeks after birth.

Operation: In NAHMS application, a farm or ranch that is participating in the NAHMS survey program.

PMR: Proportionate mortality ratio.

Practitioner: The private practice veterinarian routinely used by the producer.

Prevalence: The number of cases of disease in a population at a particular point in time.

Prevention costs: Costs incurred for prevention of disease or related conditions, including the cost of drugs, vaccines, and labor as well as foot baths, minerals, and other types of supplies.

Preventive measures: Any acts performed for the purpose of avoiding disease or related conditions.

Producer: In NAHMS usage, the rancher or farmer who reports to a VMO on animal health events.

Proportionate mortality ratio: The proportion of all deaths in a herd due to a specific disease.

Replacement value: The cost to replace an animal of the same age and genetic potential as reported by the producer.

Round: The specific period during which NAHMS conducts a survey of chosen producers to gather information on animal health events.

Salvage value: The price of salvaging an animal minus transportation costs.

Size strata: Division of Michigan NAHMS dairy herds into four groups based on the number of adult cows in the herd: 1) 10-49; 2) 50-99; 3) 100-199; and 4) 200 cows or more.

Treatment costs: Costs incurred for the treatment of a health event, including the cost of drugs, labor, and veterinary service.

USDA: United States Department of Agriculture.

VMO: Veterinary Medical Officer.

VS: Veterinary Service.

Young stock: In Michigan NAHMS, the period of an animal's life from weaning until the female has her first calf, or until a male is first used as breeding stock.

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Health Events by Disease Group

Congenital Defects

Anal Aplasia
Cleft Palate
Congenital Defects, Unspecified

Gastrointestinal

Actinomycosis
Bloat
Coccidiosis
Constipation
Displaced Abomasum
Diarrhea
Enteritis
Enterotoxemia
Hardware Disease
Indigestion
Intestinal Hemorrhage
Intestinal Infection
Intestinal Obstruction
Pneumoenteritis
Polyphagia
Stomach Ulcers

Integumentary

External Parasites
Fungal Skin Infection
Hematoma
Mycotic Dermatitis

Lameness

Lameness

Mastitis

Mastitis

Metabolic/Nutritional

Acidosis
Downer Cow Syndrome
Ketosis
Mineral Deficiency
Milk Fever
Overweight
Vitamin Deficiency
White Muscle Disease

Multiple System

Abscess
Accident
Agalactia
Allergy
Death, Unspecified
Encephalitis
Fever
Infection, Unspecified
Injury
Lethargy
Lymphoma
Neoplasm
No Milk Letdown
Off Feed
Poisoning
Poor Condition
Systemic Infection
Weakness
Weight Loss

Musculoskeletal

Bone Fracture
Joint Dislocation
Obturator Paralysis
Split Pelvis

Organs of Special Sense

Cancer Eye
Eye Infection
Eye Injury
Pinkeye

Problems at Birth

Abortion
Dystocia
Uterine Prolapse
Uterine Torsion
Retained Placenta
Vaginal Tear

Reproductive

Anestrus
Cystic Ovary
False Pregnancy
Metritis
Pyometra
Vaginitis
Repeat Breeder Syndrome
Reproductive Problems, Unspecified

Respiratory

Pneumonia
Respiratory Problems, Unspecified
Upper Respiratory Problems

Urogenital

Bloody Quarters Without Mastitis
Milk Calculi
Nephritis
Teat and Udder Problems
Udder Edema
Urinary Cystitis
Urinary Tract Infection

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National Animal Health Monitoring System

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